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Occurrence of cucumber mosaic virus (CMV) in cucumber (*Cucumis sativus* L.) growing areas of Bagalkot district of Karnataka

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Abstract

A roving survey was conducted in six taluks of Bagalkot districts during 2018-19 for the per cent disease incidence of cucumber mosaic virus (CMV) and aphids population in top three leaves. In the CMV infected plants, yellow to dark green mottling, crackling and downward curling were typical symptoms. This virus is transmitted by aphids in a non-persistent manner. During survey it was observed that, the disease incidence ranged from 13.33-66.66 per cent. Highest mean incidence of disease was noticed in Badami taluk (49.58%) whereas disease incidence lowest in Jamakhandi taluk (29.50%). More number of aphids population was observed in Badami (18.10) and least population in Jamakhandi (10.75).

Keywords: Cucumber mosaic virus, aphids, disease incidence

Introduction

Cucumber (*Cucumis sativus* L.) is one of the most popular and widely cultivated warm season vegetable crop belong to Cucurbitaceae family. Out of 118 genera and 825 species of Cucurbitaceae, 36 genera and 100 species are found in India (Chakravarty *et al.*, 1982). In Karnataka cucumber occupies an area of 8660 hectare and production of 146,020 metric tonnes. The major cucumber growing districts are Bagalkot, Bangalore rural, Belgaum, Bellary, Bidar, Chikballapur, Dharwad, Hassan, Haveri, Koppal, Mandya, Ramanagara (Anon., 2017). In 100 g of salad cucumber contain 95 per cent water, 67 kilojoules, 16 per cent vitamin K. It also contains high levels of cucurbitacin, which may help to prevent cancer by stopping cancer cells proliferating and surviving (Anon., 2019). The lower production of the crop is due to several diseases most important among them are the viral diseases like, cucumber mosaic virus (CMV), watermelon mosaic virus (WMV), zucchini yellow mosaic virus (ZYMV), tobacco mosaic virus (TMV) and potato virus-Y (PVY) (Sydanmetsa and Mbanzibwa, 2016) causing problem in cucumber production and productivity. Among which CMV occurring worldwide with a wider host range and causing yield loss up to 100 per cent (Zitter and Murphy, 2009). Cucumber mosaic virus (CMV), belongs to genus Cucumovirus in the family Bromoviridae. CMV is icosahedral, tripartite positive single-stranded positive sense RNA genome (RNAs 1, 2 and 3) (Nault, 1997). It is transmitted by more than 60 aphid species in a non-persistent manner and about more than (Chakravarty *et al.*, 1982). Additionally, CMV can also transmitted by vector, mechanical means, grafting, seeds and dodder (Ferreira, 2014). Therefore, it was required to conducted a roving survey for incidence of cucumber mosaic virus in cucumber growing areas.

Materials and Methods

A roving survey was carried out during 2018-19 in 6 taluks of Bagalkot districts *viz.*, Badami, Bagalkot, Bilagi, Hungund, Jamakhandi and Mudhol for the prevalence of cucumber mosaic virus in cucumber. A minimum 4 village in each taluk were selected for observation. The details of surveyed places, stage of the crop, number of aphids in top 3 leaves and per cent disease incidence (PDI) were recorded (Table 1). In each field per cent disease incidence, total plants and infected plants in a randomly selected rows were counted and used to calculate PDI using the formula.

$$\text{Per cent Disease Incidence} = \frac{\text{Total number of infected plants}}{\text{Total number of plants observed}} \times 100$$

The aphids population were also recorded from top 3 leaves of randomly selected 5 plants during survey. From each field, 10 leaves which shown various symptoms were collected in polythene bags and brought to the laboratory for testing presence of CMV virus through ELISA.

Symptomatology

The cucumber fields observed during survey was shown the different symptoms of CMV viz., young leaves shown small greenish mosaic patches, dark green mottling, leaf distortion, crinkling, down ward curling of leaves and stunting of plants. On fruits dark green warts with pale green fruits, misshaping, reduction in size and there is a final reduction in market value of fruits (Figure 1).



Fig 1: Symptoms of cucumber mosaic virus observed on cucumber during survey. (A) growing leaves showing mosaic symptoms, (B) dark green warts on pale green fruits, (C) *Aphis gossypii* population on leaf and (D) farmers growing maize as border and using yellow sticky traps

Results and Discussion

Per cent disease incidence

A total of twenty-two villages were surveyed in the period of 2018-19 to record disease incidence and aphids population in cucumber growing area of 6 taluks of Bagalkot district. The severity of CMV incidence in Bagalkot district, varied from 13.33-66.66 per cent. The highest disease incidence was seen in Badami taluk (49.58%), followed by Bilagi (44.80%), Hunagund (41.07%), Bagalkot taluk (39.00%), Mudhol (36.97%) and least incidence recorded in Jamakhandi (29.50%). Overall the Bagalkot district has shown the 40.15% of CMV disease incidence. A total of 240 leaf samples collected during survey out of which only 169 samples shown positive results to DAS-ELISA.

Revadi and Patil (2017) conducted survey for the incidence of CMV during 2014-15 in 4 districts of North Karnataka. The highest CMV recorded in Dharwad (27.22%), followed by Haveri (26.79%), Belagavi (26.66%) and lowest in Bagalkot (24.69%) in kharif season. In Iran during 2005-06, Bananej and Vahdat (2008) collected 289 CMV symptomatic cucumber leaf sample in open field for virus detection of which 95 samples show positive result by DAS-ELISA.

The highest mean incidence of CMV (51.76 %) was recorded in harvesting stage, followed by flowering stage (44.78%) and vegetative stage (24.13%). The disease incidence increased with age of crop because the infected plants served as source

for further spread (Table 2). Revadi and Patil (2017) were also observed the highest mean incidence of CMD (23.50%) in cucumber at harvesting stage compared to flowering stage (20.49%) during survey.

Aphids population

During survey the maximum number of aphids population were observed in Badami (18.10) followed by Bilagi (17.40), Hunagund (15.68), Bagalkot (14.33), Mudhol (13.80) and minimum in Jamakhandi (10.75). The lower aphids population in Mudhol and Jamakhandi taluks because the farmers in these area are adopting recommended management practices like growing maize of 2-3 lines as a border crops around the field, as well as intercrop, standing yellow sticky traps and using silver reflective mulching sheet for growing cucumber, which help to reduce aphid population and spread of aphid transmitting viruses. The aphids were attracted by yellow colour of yellow sticky sheets. The silver reflective mulches will reflect short wave length light which confuses the incoming alate aphids, resulting in reduction of number of aphids alighting on plants (Narayanasamy 2013). Cucumber mosaic virus is one of the most wide spread viral disease with wider host range. With the adaptation of recommended management practice for the management of aphids the viral disease incidence and spread can be reduced.

Table 3: Survey for the incidence of mosaic virus disease in cucumber in major growing areas of Bagalkot district.

Sl. No.	Taluk	Village	Stage crop	Other	Aphids population in top 3 leaves	Per cent disease incidence (%)
1.	Badami	Jammankatti	Flowering	Maize grown as border crop	30.4	13.33
		Mahakoota	Harvesting	-	11.2	57.57
		Nagaral (S.B)	Vegetative	-	18.4	60.00
		Neerkerur	Harvesting	-	12.4	51.42
		Mean				18.10
2.	Bagalkot	Honnakatti	Flowering	Cluster bean grown as mixed crop	8.9	30.00
		Halevirapur	Harvesting	Sorghum	16	28.57
		Haveli	Harvesting	-	16.8	46.66
		Tulasigeri	Harvesting	-	15.6	50.79
		Mean				14.33
3.	Bilagi	Anagwadi	Vegetative	-	12	28.57
		Bilagi TP	Vegetative	-	20.4	66.66
		Kundaragi	Vegetative	Mixed crop with sugarcane, Maize	19.2	44.00
		Yadahalli	Vegetative	Maize grown as intercrop	18	40.00
		Mean				17.40
4.	Hungund	Amingad	Flowering	-	13.5	30.30
		Dhannur	Harvesting	-	10.4	40.00
		Hungund	Harvesting	-	23.2	44.00
		Kelur	Harvesting	-	15.6	50.00
		Mean				15.68
5.	Jamakhandi	Kannoli	Harvesting	Black sheet mulching	10.4	44.44
		Navalagi	Flowering	Black sheet mulching, Maize boarder crop	9.4	18.18
		Teradala	Flowering	Mixed crop with methi, okra, coriander	14	50.00
		Tungal	Vegetative	Black sheet mulching	9.2	35.29
		Mean				10.75
6.	Mudhol	Belagali	Flowering	Black sheet mulching, yellow sticky traps	12.8	19.00
		Malali	Vegetative	-	15.8	39.00
		Mugalkhod	Harvesting	Black sheet mulching	12.2	26.00
		Nagaral	Flowering	Maize grown as intercrop	14.4	34.00
		Mean				13.80
Mean disease incidence of CMV in Bagalkot district						40.15

Table 2: Disease incidence based on stages of crop in Bagalkot district

Stage of crop	% disease incidence
Vegetative	44.78
Flowering	24.13
Harvesting	51.76

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